

CLAIMS

What is claimed is:

1. A filter apparatus for filtering contaminants from a fluid, said filter apparatus comprising:
 - an inlet on said filter apparatus configured to receive said fluid into said filter apparatus;
 - a centrifugal separator hydraulically connected to said inlet, said centrifugal separator having a rotor housing forming of a rotor chamber and a rotor rotatably disposed inside said rotor chamber, said centrifugal separator configured to separate said fluid into a separated fluid and one or more classes of contaminated fluids;
 - a chamber assembly having more than one chamber for receiving and filtering said separated fluid and said one or more classes of contaminated fluids to obtain a processed fluid;
 - a base assembly interconnecting said centrifugal separator and said chamber assembly, said base assembly configured to selectively direct said separated fluid and said one or more classes of contaminated fluids to said more than one chamber; and

an outlet on said filter apparatus configured to discharge said processed fluid from said filter apparatus.

2. The filter apparatus according to claim 1 further comprising one or more bearing assemblies configured to permit rotation of said rotor relative to said rotor housing, each of said bearing assemblies having a shaft member disposed in a rotor bearing.

3. The filter apparatus according to claim 1, wherein said rotor and said rotor housing are generally cone shaped.

4. The filter apparatus according to claim 3, wherein said rotor is configured with a generally helical wiper.

5. The filter apparatus according to claim 4, wherein said fluid is supplied from a source of pressurized fluid and said rotor is configured with one or more rotor jets in fluid communication with said source of pressurized fluid, said one or more rotor jets configured to rotate said rotor in said rotor housing.

6. The filter apparatus according to claim 1, wherein said fluid is supplied from a source of pressurized fluid and said rotor is configured with one or more rotor jets in fluid communication with said source of pressurized fluid, said one or more rotor jets configured to rotate said rotor in said rotor housing.

7. The filter apparatus according to claim 1, wherein said rotor housing has one or more channels in hydraulic communication with said chamber assembly.

8. The filter apparatus according to claim 7, wherein said rotor housing has a first rotor housing channel and said chamber assembly has a settling chamber, said first rotor housing channel hydraulically interconnecting said rotor chamber and said settling chamber, said first rotor housing channel hydraulically connected at or near the bottom of said rotor chamber.

9. The filter apparatus according to claim 8, wherein said rotor housing has a second rotor housing channel and said chamber assembly has a volatile chamber, said second housing channel hydraulically interconnecting said rotor chamber and said volatile chamber, said second rotor housing channel hydraulically connected at or near the top of said rotor chamber.

10. The filter apparatus according to claim 1, wherein said chamber assembly comprises a filter chamber, a settling chamber and a volatile chamber and said one or more classes of contaminated fluids comprises a particulate fluid and a volatile fluid, each of said filter chamber, said settling chamber and said volatile chamber having a filter element disposed therein, said filter chamber configured to receive said separated fluid from a bottom side of said rotor

chamber and filter said separated fluid, said settling chamber configured to receive said particulate fluid from an outer edge of said rotor chamber and filter said particulate fluid, said volatile chamber configured to receive said volatile fluid from a top side of said rotor chamber and filter said volatile fluid.

11. The filter apparatus according to claim 10, wherein each of said filter chamber and said volatile chamber are hydraulically connected to said outlet and said settling chamber is hydraulically connected to said top side of said rotor chamber.

12. The filter apparatus according to claim 10, wherein said filter element in said settling chamber is configured for generally vertical filtering of said particulate fluid and said filter element in said volatile chamber is configured for generally vertical filtering of said volatile fluid.

13. The filter apparatus according to claim 11, wherein said chamber assembly is configured to store particulate matter in said settling chamber and store volatile material in said volatile chamber.

14. The filter apparatus according to claim 10 further comprising a flange in said settling chamber, said flange positioned above said filter element and configured to direct the flow of said particulate fluid to said filter element.

15. The filter apparatus according to claim 10, wherein each of said filter chamber, said settling chamber and said volatile chamber are removably connected to said base assembly.

16. The filter apparatus according to claim 10, wherein said filter elements in said settling chamber and said volatile chamber are configured to reduce or eliminate turbulence therein.

17. The filter apparatus according to claim 1, wherein said at least one of said more than one chamber is configured to receive said separated fluid and at least one of said more than one chamber is configured to receive said one or more classes of contaminated fluids.

18. The filter apparatus according to claim 1, wherein at least one of said more than one chamber is removably connected to said base assembly.

19. The filter apparatus according to claim 1, wherein each of said more than one chamber has a bottom section removably attached thereto for access to the interior thereof.

20. The filter apparatus according to claim 1, wherein each of said more than one chamber has a filter element disposed therein.

21. The filter apparatus according to claim 20, wherein at least one of said more than one chamber has a filter element configured to reduce or eliminate turbulence therein.

22. The filter apparatus according to claim 1 further comprising one or more flow restrictors in said base assembly.

23. The filter apparatus according to claim 1, wherein said chamber assembly comprises one or more tanks, said one or more tanks forming said more than one chamber.

24. A filter apparatus for filtering contaminants from a pressurized fluid, said filter apparatus comprising:

an inlet on said filter apparatus configured to receive said pressurized fluid into said filter apparatus;

a centrifugal separator hydraulically connected to said inlet, said centrifugal separator having a rotor housing forming of a rotor chamber and a rotor rotatably disposed inside said rotor chamber, said centrifugal separator configured to separate said fluid into a separated fluid, a particulate fluid and a volatile fluid, said rotor having one or more rotor jets configured to discharge said pressurized fluid so as to rotate said rotor in said rotor housing;

a chamber assembly having a filter chamber, a settling chamber and a volatile chamber, each of said filter chamber, said settling chamber and said volatile chamber having a filter element disposed therein, said filter chamber configured to receive said separated fluid from a bottom side of said rotor chamber, said settling chamber configured to receive said particulate fluid from an outer edge of said rotor chamber, said volatile chamber configured to receive said volatile fluid from a top side of said rotor chamber;

a base assembly interconnecting said centrifugal separator and said chamber assembly, said base assembly configured to selectively direct said separated fluid and said one or more classes of contaminated fluids to said more than one chamber; and

an outlet on said filter apparatus.

25. The filter apparatus according to claim 24 further comprising one or more bearing assemblies configured to permit rotation of said rotor relative to said rotor housing, each of said bearing assemblies having a shaft member disposed in a rotor bearing.

26. The filter apparatus according to claim 24, wherein said rotor and said rotor housing are generally cone shaped.

27. The filter apparatus according to claim 27, wherein said rotor is configured with a generally helical wiper.

28. The filter apparatus according to claim 24, wherein said rotor housing has one or more channels in hydraulic communication with said chamber assembly.

29. The filter apparatus according to claim 28, wherein said rotor housing has a first rotor housing channel hydraulically interconnecting said rotor chamber and said settling chamber.

30. The filter apparatus according to claim 29, wherein said rotor housing has a second rotor housing channel hydraulically interconnecting said rotor chamber and said volatile chamber.

31. The filter apparatus according to claim 24, wherein each of said filter chamber and said volatile chamber are hydraulically connected to said outlet and said settling chamber is hydraulically connected to said top side of said rotor chamber.

32. The filter apparatus according to claim 24, wherein said filter element in said settling chamber is configured for generally vertical filtering of said particulate fluid and said filter element in said volatile chamber is configured for generally vertical filtering of said volatile fluid.

33. The filter apparatus according to claim 32, wherein said chamber assembly is configured to store particulate matter in said settling chamber and store volatile material in said volatile chamber.

34. The filter apparatus according to claim 24 further comprising a flange in said settling chamber, said flange positioned above said filter element and configured to direct the flow of said particulate fluid to said filter element.

35. The filter apparatus according to claim 24, wherein each of said filter chamber, said settling chamber and said volatile chamber are removably connected to said base assembly.

36. The filter apparatus according to claim 24, wherein said filter elements in said settling chamber and said volatile chamber are configured to reduce or eliminate turbulence therein.

37. The filter apparatus according to claim 24 further comprising one or more flow restrictors in said base assembly.

38. A method of filtering contaminants from a fluid, said method comprising the steps of:

- (a) receiving said fluid from a source of fluid into a filter apparatus;
- (b) separating said fluid in a separator into at least a first class of contaminated fluid and a second class of contaminated fluid;

(c) directing said first class of contaminated fluid into a first chamber and said second class of contaminated fluid into a second chamber;

(d) filtering said first class of contaminated fluid in said first chamber and said second class of contaminated fluid in said second chamber to obtain a processed fluid; and

(e) discharging said processed fluid to said source of fluid.

39. The method of claim 38, wherein said fluid is from a source of pressurized fluid.

40. The method of claim 39, wherein said separating step is accomplished with a centrifugal separator having a rotor with one or more rotor jets rotatably disposed in a rotor chamber, said rotor jets in communication with said source of pressurized fluid and configured to rotate said rotor in said rotor chamber.

41. The method of claim 40, wherein said rotor is conically-shaped and configured with a generally helical wiper.

42. The method of claim 38, wherein said separating step is accomplished with a centrifugal separator having a rotor rotatably disposed in a rotor chamber.

43. The method of claim 38 further comprising the step of returning at least a portion of said processed fluid to said separator after said filtering step to repeat steps (b) through (d).

44. The method of claim 38, wherein said separating step separates said fluid into a separated fluid, particulate fluid and a volatile fluid and said directing step directs said separated fluid into a filter chamber, said particulate fluid into a settling chamber and said volatile fluid into a volatile chamber.

45. The method of claim 44, wherein said filtering step is accomplished with a filter element disposed in each of said filter chamber, said settling chamber and said volatile chamber.

46. The method of claim 44, wherein said separating step is accomplished with a centrifugal separator having a rotor rotatably disposed in a rotor chamber.

47. The method of claim 46, wherein said filter chamber is configured to receive said separated fluid from a bottom side of said rotor chamber, said settling chamber is configured to receive said particulate fluid from an outer edge of said rotor chamber, said volatile chamber is configured to receive said volatile fluid from a top side of said rotor chamber.

48. The method of claim 38, wherein said filtering step is accomplished with a filter element disposed in each of said first chamber and said second chamber.

49. The method of claim 38, wherein at least one of said first chamber and said second chamber is removably connected to said filter apparatus.

50. The method of claim 38, wherein said directing step is accomplished with a base assembly disposed between said separator and said first chamber and said second chamber.

51. The method of claim 50, wherein said base assembly comprises one or more channels, one or more ports and one or more flow restrictors.

52. A method of filtering contaminants in a lubricating fluid from an engine lubricating system, said method comprising the steps of:

- (a) receiving said lubricating fluid into a filter apparatus;
- (b) separating said lubricating fluid with a centrifugal separator into a separated fluid, a particulate fluid and a volatile fluid, said centrifugal separator having a rotor rotatably disposed in a rotor chamber, said rotor having one or

more rotor jets in communication with said source of pressurized fluid and configured to rotate said rotor in said rotor chamber;

(c) directing said separated fluid to a filter chamber, said particulate fluid to a settling chamber and said volatile fluid to a volatile chamber;

(d) filtering said separated fluid, said particulate fluid and said volatile fluid to obtain a processed fluid; and

(e) discharging said processed fluid to said source of fluid.

53. The method of claim 52, wherein said rotor is conically-shaped and configured with a generally helical wiper.

54. The method of claim 52 further comprising the step of returning at least a portion of said processed fluid to said centrifugal separator after said filtering step to repeat steps (b) through (d).

55. The method of claim 52, wherein said filtering step is accomplished with a filter element disposed in each of said filter chamber, said settling chamber and said volatile chamber.

56. The method of claim 52, wherein said filter chamber is configured to receive said separated fluid from a bottom side of said rotor chamber, said settling chamber is configured to receive said particulate fluid from

an outer edge of said rotor chamber, said volatile chamber is configured to receive said volatile fluid from a top side of said rotor chamber.

57. The method of claim 52, wherein at least one of said filter chamber, said settling chamber and said volatile chamber is removably connected to said filter apparatus.

58. The method of claim 52, wherein said directing step is accomplished with a base assembly disposed between said centrifugal separator and said filter chamber, said settling chamber and said volatile.

59. The method of claim 59, wherein said base assembly comprises one or more channels, one or more ports and one or more flow restrictors.

60. The method of claim 52, wherein said lubricating fluid is oil.

61. The method of claim 60, wherein said engine lubricating system is used with an internal combustion engine.